Claims:

1. A solid catadioptric lens having a single viewpoint on an optical axis and comprising:
   a) a spherical refractive surface having a center C on said optical axis;
   b) an ellipsoidal reflective surface facing said spherical refractive surface and having a first focus F_1 coincident with said center C, whereby said center C is said single viewpoint; and
   c) a shaping surface facing said ellipsoidal reflective surface for shaping a light passing said single viewpoint.

2. The solid catadioptric lens of claim 1, wherein said shaping surface is a refractive shaping surface and said solid catadioptric lens further comprises an aperture for enforcing said single viewpoint.

3. The solid catadioptric lens of claim 2, wherein said aperture is positioned at a second focus F_2 of said ellipsoidal reflective surface.

4. The solid catadioptric lens of claim 3, wherein said second focus F_2 is on said optical axis and substantially at said refractive shaping surface.

5. The solid catadioptric lens of claim 3, wherein said second focus F_2 is on said

optical axis and inside said solid catadioptric lens.

6. The solid catadioptric lens of claim 2, wherein said refractive shaping surface is an ellipsoidal refractive shaping surface.

7. The solid catadioptric lens of claim 6, wherein said ellipsoidal refractive shaping surface has a first focus F_1' coincident with said second focus F_2.

8. The solid catadioptric lens of claim 7, wherein said ellipsoidal refractive shaping surface has a conic constant K_2 equal to a conic constant K_1 of said ellipsoidal reflective surface.

9. The solid catadioptric lens of claim 1, wherein said shaping surface is a reflective shaping surface and said solid catadioptric lens further comprises an aperture for enforcing said single viewpoint.

10. The solid catadioptric lens of claim 9, wherein said aperture is positioned at said ellipsoidal reflective surface.

11. The solid catadioptric lens of claim 9, wherein said aperture is positioned beyond said ellipsoidal reflective surface.

12. The solid catadioptric lens of claim 9, wherein said reflective shaping surface is a second ellipsoidal reflective shaping surface.

13. The solid catadioptric lens of claim 12, wherein said second ellipsoidal reflective shaping surface has a first focus F_1' coincident with said second focus F_2.

14. The solid catadioptric lens of claim 12, wherein said second ellipsoidal reflective shaping surface has a conic constant K_2 equal to a conic constant K_1 of said ellipsoidal reflective surface.

15. The solid catadioptric lens of claim 1 comprising an optical material having an index n.

16. The solid catadioptric lens of claim 1, wherein said shaping surface is a semi-transparent shaping surface.

17. The solid catadioptric lens of claim 1, wherein said shaping surface is selected from the group consisting of a flat shaping surface, an ellipsoidal shaping surface and a paraboloid shaping surface.

18. A single viewpoint vision system comprising:

a) a solid catadioptric lens having an optical axis;

b) a spherical refractive surface having a center C on said optical axis;

c) an ellipsoidal reflective surface facing said spherical refractive surface and having a first focus F_1 coincident with said center C, whereby said center C is said single viewpoint; and

d) a shaping surface facing said ellipsoidal reflective surface for shaping a light passing said single viewpoint.

19. The single viewpoint vision system of claim 18, further comprising an optical relay for passing said light.

20. The single viewpoint vision system of claim 18, wherein said shaping surface is selected from the group consisting of reflective shaping surface, refractive shaping surface and semi-transparent shaping surface.

21. The single viewpoint vision system of claim 18, wherein said shaping surface is selected from the group consisting of a flat shaping surface, an ellipsoidal shaping surface and a paraboloid shaping surface.

22. The single viewpoint vision system of claim 18, further comprising an element selected from the group consisting of scanning arrangement, imaging element and a display unit.